REMARKS/ARGUMENTS

Favorable reconsideration of this application is requested in view of the following remarks and discussion.

Claims 4-8, 11, 13-15, and 18-31 are pending. No claims are amended or newly added. Claims 4-7, 11, and 22-27 are withdrawn. No new matter is added.

In the outstanding Office Action, Claims 8, 13-15, and 18-20 were rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi et al. (U.S. Patent Pub. 2003/0106647, herein "Koshiishi") in view of Kanno et al. (U.S. Patent No. 6,373,681, herein "Kanno"), Howald et al. (U.S. Patent No. 6,125,025, herein "Howald") and Moriya et al. (U.S. Patent Pub. 2002/0037652, herein "Moriya"). Claim 21 was rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi, Kanno, Howald, Moriya, and Huang (U.S. Patent Pub. No. 2004/0005726, herein "Huang"). Claim 30 was rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi, Kanno, Howald, Moriya, and Hasegawa et al. (U.S. Patent No. 5,556,500, herein "Hasegawa"). Claim 31 was rejected under 35 U.S.C. § 103(a) as obvious over Koshiishi, Kanno, Howald, Moriya, and Birang et al. (U.S. Patent No. 5,491,603, herein "Birang").

Regarding the rejection of Claim 8 as obvious over Koshiishi, Kanno, Howald, and Moriya, that rejection is respectfully traversed by the present response.

Independent Claim 8 recites, in part:

> ... a controller that controls the chuck voltage applied to said chuck device, said controller changing the chuck voltage in accordance with each of multiple sequences of a plasma process; and
>
> a chamber having said susceptor therein, wherein:
>
> said controller sets the chuck voltage applied to the chuck device high during at least one processing sequence;
>
> said groove is formed in said electrostatic chuck;
>
> said heat exchange means further comprises a supply path that supplies a heat transfer gas to said contact surface;
>
> said controller controls a pressure of the heat transfer gas supplied from said heat exchange means and changes the

> pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process; and
>
> the chuck voltage and the pressure of the heat transfer gas are not set to zero so as to carry out cooling of said focus ring **during conveying the object to be processed into and out from said chamber**.

Accordingly, the chuck voltage and the pressure of the heat transfer gas are not set to zero during conveying the object to be processed into and out of the process chamber.

One benefit of the above-noted arrangement is that it is possible to prepare for the dry etching of the next wafer W, i.e. to completely or almost completely remove the heat from the focus ring (30), and thus make the dry etching conditions more uniform for all of the wafers W.

In contrast, Koshiishi describes changing a DC voltage applied to a wafer-attracting electrode (22) (paragraph [0057]).

Kanno describes that an electrostatic chuck has a structure in which a wafer mounting surface of the chuck is provided with a dispersion groove (col. 2, lines 49 to 59).

Howald describes reducing, as a function of time, the value of a voltage applied by a source (38) to a chuck (30) clamping a workpiece as a substrate (col. 15, lines 59 to 64), and controlling the source (38) to derive a sequence of time spaced decreasing step voltages during processing of glass (substrate) (col. 16, lines 7 to 9).

Birang describes controlling the pressure of an inert gas such as helium pumped against the bottom side of a semiconductor wafer (101) in respective processing steps (col. 7, lines 28 to 31 and 57 to 61).

Huang describes a heat transfer means (54) adjusting the temperature of a focus ring (52) (Fig. 3).

Moriya describes a computer (21) to which signals indicating various process conditions of the semiconductor substrate, such as the opening of a gate valve transporting the semiconductor substrate (Isolation Valve), the flow of helium for cooling (He flow rate),

the electrostatic chucking voltage (ESC voltage), and the electrostatic chucking current (ESC current) are inputted (paragraph 0056, lines 13 to 26.)

Hasegawa describes placing and attaching an annular thin plate part (116) formed of tungsten, etc., which corresponds to an outer part (106) of a focus ring (102) on an outer circular surface of a base part (114) which corresponds to an inner part (104) of the focus ring (102) (col. 9, lines 51 to 60 and FIG. 6), and placing and attaching an annular thin plate part (124) formed of amorphous carbon, etc., which corresponds to the inner part (104) on an inner circular surface of a base part (126) of the focus ring (102) (col. 9, line 65 to col. 10, line 6 and FIG. 6). Hasegawa, in claim 1, discusses properties of a focus ring "so that said reaction product generated from said second surrounding surface diffuses to said major surface of said substrate **while said plasma is being generated**, thereby correcting a distribution of the amount of the reaction product on said major surface."

The outstanding Office Action acknowledges that Koshiishi, Kanno, and Howald do not disclose a controller that changes the pressure of a heat transfer gas supplied in accordance with multiple steps of plasma processing and controls the chuck voltage and pressure of the heat transfer gas so as not to set these parameters to zero during conveying the object to be processed into and out of the chamber.[1] The outstanding Office Action relies on Moriya for the above-noted feature.[2] The outstanding Office Action states:

> Moriya et al teach a plasma apparatus comprising a processing chamber 7 having a lower electrode 3 with an electrostatic chucking by means of power supply 12 to fix a substrate 1 to a stage 5. Moriya et al also teach that helium gas that is flowed under the ESC for cooling purposes. Moriya et al additionally teach a computer 21 with a signal processor 23 that controls the conveyance in/out of wafer, the flow (related to pressure) of helium gas for cooling, and supply of chucking voltage to the electrostatic chuck (e.g. Fig. 3, 15 and para. 0056, 0072-0078). It would be obvious to program the controller and processor for controlling the supply of chucking

[1] Outstanding Office Action, page 6.
[2] Id.

> voltage and pressure of helium gas during all processing steps including during conveyance in/out of substrate. Specific values of voltage and pressure would be dependent upon process limitations like processing temperature, desired temperature of wafer, focus ring, and gas pressure etc.
>
> Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use *a controller that controls the pressure of the heat exchange gas and supply of chucking voltage to electrostatic chuck during all processing steps including during conveyance in/out of substrate as taught by Moriya* et al in the apparatus of Koshiishi et al in view of Kanno et al and Howald et al to obtain uniform processing of substrate over the entire diameter.[3]

Regarding the statement in the outstanding Office Action that Moriya teaches "*a controller that controls the pressure of the heat exchange gas and supply of chucking voltage to electrostatic chuck during all processing steps including during conveyance in/out of substrate...,*" Applicants respectfully note that Moriya does not supply a cooling gas and non-zero voltage when the substrate is transferred into and out of the chamber.

Moreover, the outstanding Office Action asserts that it would be an obvious program change to program the controller to supply a chucking voltage and a positive pressure of helium gas during conveyance into and out of the processing chamber.

As a reason for the above-noted change to the primary reference, the outstanding Office Action asserts that specific values of voltage and pressure are dependent on process limitations.[4] Applicants respectfully note that Moriya is directed to processing a substrate **while generating a minimum number of particles**. To achieve this goal, Moriya describes a suction pump and suction path capable of reducing a pressure within a suction path to a pressure that is lower than a pressure within the processing chamber during processing. Moriya is not concerned with cooling during transfer of a substrate into or out of a chamber,

[3] Outstanding Office Action, pages 6-7 (emphasis added).
[4] Outstanding Office Action, page 7.

much less the effect created when a substrate is transferred into and out of a chamber while providing additional cooling to a focus ring.

All the techniques of the above-noted references are based on the fact that a wafer (an object to be processed) stays inside a chamber and is being electrostatically attracted to a mounting stage (a susceptor).

In contrast, independent Claim 8 recites control performed during conveying the object to be processed into and out from the chamber. In other words, Claim 8 is not based on the fact that the object to be processed stays inside the chamber and is being electrostatically attracted to the susceptor.

If the temperature of the focus-ring were to change from a desired temperature during conveying the object to be processed into and out from the chamber, a desired process result would not be obtained in processing for a next object to be processed. To ameliorate this problem, in the apparatus recited in independent Claim 8, the chuck voltage and the pressure of the heat transfer gas are purposely not set to zero so as to adjust the temperature of the focus-ring to the desired temperature during conveying the object to be processed into and out from the chamber. The apparatus recited in Claim 8 takes into consideration not only current processing but also next processing for an object which has not been conveyed into the chamber. As a result, the apparatus recited in Claim 8 addresses a different problem from the techniques of the cited references which merely take into consideration processing for the wafer which has already been conveyed into the chamber.

Each of Claims 13-15, 18-21, and 28-31 depend, directly or indirectly, from independent Claim 1 and patentably distinguish over any proper combination of the cited references for at least the same reasons as independent Claim 1 does.

For the foregoing reasons, it is respectfully submitted that this application is now in condition for allowance. A Notice of Allowance for Claims 8, 13-15, 18-21, and 28-31 is earnestly solicited.

Should Examiner Dhingra deem that any further action is necessary to place this application in even better form for allowance, Examiner Dhingra is encouraged to contact Applicants' undersigned representative at the below-listed telephone number.

Respectfully submitted,

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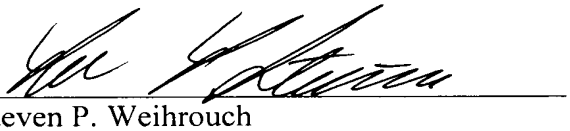

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